VASCULAR PLANTS ON A GYPSUM OUTCROP IN SOUTHERN NEW MEXICO: A LISTING, A NEW VARIETY AND TAXONOMIC REALIGNMENTS IN THE *ANULOCAULIS LEIOSOLENUS* COMPLEX (NYCTAGINACEAE), AND A NEW VARIETY OF *MENTZELIA HUMILIS* (LOASACEAE)

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ABSTRACT

A survey of the flora on a hitherto unexplored gypsum outcrop on the west face of the Guadalupe Mountains in southern New Mexico has revealed a new variety of *Anulocaulis* (Nyctaginaceae), *A. leiosolenus* (Torr.) Standl.var. *howardii* Spellenb. & Wootten (var. nov.). This variety has a combination of characteristics in various degrees intermediate to other taxa, an observation that results in the inclusion of *A. gypsogenus* Waterf. into *A. leiosolenus* as *A. leiosolenus* var. *gypsogenus* (Waterf.) Spellenb. & Wootten (comb. nov.). Also from this outcrop is described *Mentzelia humilis* (A. Gray) J. Darl. var. *guadalupensis* Spellenb. (var. nov.). Fifty-nine species in 29 families were observed to occur on the gypsum outcrop. A key is provided to all known *Anulocaulis* taxa and a list is presented documenting the other plant species that occur with it and the new variety of *M. humilis*.

RESUMEN

La exploración de la flora en un afloramiento de yeso, inexplorado previamente, en la ladera oeste de las Montañas Guadalupe en el sur de Nuevo México ha revelado una variedad nueva de *Anulocaulis* (Nyctaginaceae), *A. leiosolenus* (Torr.) Standl. var. *howardii* Spellenb. & Wootten (var. nov.). Esta variedad tiene una combinación de caracteres intermedios en varios grados con otros taxa, una observación que da como resultado la inclusión de *A. gypsogenus* Waterf. en *A. leiosolenus* así como *A. leiosolenus* var. *gypsogenus* (Waterf.) Spellenb. & Wootten (comb. nov.). También, *Mentzelia humilis* (A. Gray) J. Darl. var. *guadalupensis* Spellenb. (var. nov.) está descrita de este afloramiento. Cincuenta y nueve especies de 29 familias de plantas fueron observadas en este afloramiento de yeso. Se ofrece una clave para todos los taxa conocidos de *Anulocaulis* y se presenta una lista documentando las otras especies de plantas que conviven con las dos variedades nuevas.

INTRODUCTION

While deer hunting in southern Otero County, New Mexico, about a decade ago, Michael Howard of the Bureau of Land Management, Las Cruces District, traversed a gypsum outcrop on the western slope of the northern portion of the Guadalupe Mountains and noted an *Anulocaulis*. In the summer of 1996 he showed the plant to Wootten, who collected a voucher, identified

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the plant as *Anulocaulis gypsogenus* Waterf., and brought it to the New Mexico State University herbarium for deposition. Spellenberg immediately recognized the plant as near *A. gypsogenus* but somewhat different. That collection also brought attention to a previously unbotanized area on the west face of the Guadalupe Mountains.

Wootten and Howard visited the southern portion of the gypsum outcrop in September and November, 1996, and escorted Spellenberg to that site in early August 1997. Spellenberg and Wootten returned to the southern portion of the outcrop in September 1997 and April 1998, and to the northern, more lengthy portion of the outcrop in July, 1998. Our survey re-vealed new varieties of *Anulocaulis leiosolenus* and *Mentzelia humilus*, herein described, and resulted in a collection of plants documenting the flora of this gypsum outcrop (Appendix 1).

CHARACTERISTICS AND FLORA OF GYPSUM OUTCROP

This gypsum outcrop is part of the Permian age Yeso Formation (Hunt 1977). Most of the outcrop consists of limestone rubble, the stones 2–10 cm in diameter, or larger, overlying a pale tan, sandy, gypseous clay. In a few places, when walked upon, the gypsum makes the hollow sound characteristic of other gypsum outcrops in the Southwest. On the steeper slopes there is little limestone rubble, the gypseous matrix being completely exposed.

The outcrop is not continuously exposed and consists of two main sections. The southern section extends for about 5 km in a NNW - SSE direction, and perhaps up to 3/4 km in an E-W direction, with an elevational range of about 250 meters beginning at about 1350 m. It occurs on the lower slopes of the western escarpment of the Guadalupe Mountains, beneath The Rim, at the upper edge of the bajadas that extend westward to Crow Flats. The southern end of this section lies about 48 air km NNE of Dell City, Texas, centered on about 32°22'N, 105°04'W (Sec. 25 to estimated Sec. 11, T22S, R18E), just north of the mouth of Pup Canyon. Most of the outcrop has a very steep western exposure, the slopes 30–45° and steeper. Near the base of the outcrop at the southern end of the outcrop, and also about 2 km to the south, there are a few low, gypseous hills that have slopes of all exposures, and within the major portion of the outcrop, gullys and arroyos provide northern and southern exposures.

The southern portion of the outcrop disappears near the northern end of a small south-facing box canyon. It or a similar gypseous outcrop reappears on the western slopes of the mountains about 3 km to the NNW. From there the outcrop continues in a northwesterly direction in a discontinuous manner for about 12 km (Sec. 33, T21S, R18E northward to Sec. 25, T20S, R17E).

This outcrop occurs in an remote area where access is comparatively difficult. The entire outcrop lies on public lands, some portions entirely on those of the Bureau of Land Management, Las Cruces District, in other areas the eastern portions on the Guadalupe Ranger District of the Lincoln National Forest. Browsing of a few of the species that occur on this outcrop, probably by deer and rabbits, was noted; no sign of domestic livestock, common in the valley below, was observed. According to a local rancher, Mr. George Rauch, the livestock simply do not get up to this rather inhospitable site (he was speaking of the southern section, but conditions are similar along the length of the outcrop). The two new endemics discovered here presently do not seem to be impacted by human-related activities.

The *Anulocaulis* and the *Mentzelia* are both common and conspicuous on the outcrop. Because there are no records in collections of these taxa from here, we believe that the outcrop had not been explored by botanists prior to our work. Only a minor portion of the outcrop consists of highly concentrated gypsum, and here obligate gypsophiles such as *A. leiosolenus, M. humilus*, and *Selinocarpus lanceolatus* occur. On this portion we document 59 plant species in 29 families (Appendix 1), including the two new varieties described below. We stopped noting species when we crossed off the gypsum and onto the cobbly limestone bajadas that support Chihuahuan Desert vegetation consisting of *Larrea tridentata* (DC.) Cov., *Parthenium incanum* Kunth, *Acacia neovernicosa* Isely, *Fouquieria splendens* Engelm., *Yucca torreyi* Shafer, *Ephedra aspera* Engelm., *Dasylirion wheeleri* S. Wats., *Echinocereus pectinatus* (Scheidw.) Engelm., *Krameria erecta* Willd. ex Schultes, *Allionia incarnata* L., *Stenandrium barbatum* Torr. & A. Gray, *Polygala macradenia* A. Gray, among numerous other species.

A NEW VARIETY AND TAXONOMIC REALIGNMENTS IN *ANULOCAULIS*

Spellenberg (1993) provided a taxonomic review of *Anulocaulis* and recognized five species, one of them, *A. leiosolenus*, with two varieties. Turner (1993) described a sixth species. This present paper reduces one of the species recognized by Spellenberg to a variety in *A. leiosolenus*, and adds a fourth variety to that species. We now consider *Anulocaulis* to have five species, one with four varieties.

Anulocaulis leiosolenus (Torr.) Standl. var. **howardii** Spellenb. & T. Wootten, var. nov. TYPE: UNITED STATES. NEW MEXICO. Otero Co.: 48 km NNE of Dell City, Texas, W base of Guadalupe Mts., N of mouth of Pup Canyon, ca. 50 m SW of NE corner S26, T22S, R18W, 32°22.14'N, 105°03.92'W, elev. 1360 m, 5 Aug 1997, *Spellenberg, Wootten, and Howard 12433* (HOLOTYPE: NMC; ISOTYPES: NY, TEX, UNM).

A Anulocaule leiosoleno var. leiosoleno perianthiis rubro-roseis (vs. albis vel subroseis dilutis) foliis leviter glaucis et parce tuberculatis (vs. viridis non glaucis et dense tuberculatis) differt.

Strong perennial from gnarled woody root. *Stems* 1-ca. 6, ascending, branched in upper 70%, up to ca. 1.2 m tall, glabrous, glaucous. *Leaves* usually in 2–3 pairs in basal 1/4 of plant; petioles 35–50 mm long, blades more or less orbicular, commonly wider than long, 45–105 mm long, 45–135 mm wide, semi-glaucous, bluish-green, with sparse purplish pustules, pustules slightly denser on abaxial surface. *Inflorescences* widely paniculate, forming the upper 2/3 of the plant, the flowers borne terminally and on short side branches in more or less congested clusters. *Buds* with minute hairs at the apex. *Perianth* deep rose-pink, obliquely funnelform, 22–32 mm long, limb 10–17 mm wide, stamens exserted ca. 20 mm, the style 25 mm. *Fruit* biturbinate, 4.3–5.9 mm long, 3.7–4.5 mm wide, with 10 irregular longitudinal ridges and an equatorial wing 0.2–0.9 mm wide.

At present, the new *Anulocaulis* is known only from the western slope of the Guadalupe Mountains in south-central New Mexico on tannish, shaley, gypseous clays, and then only from the southern portion of the gypsum outcrop, immediately north of Pup Canyon. Exploration of the outcrop to the north revealed no other populations. We name the plant for its discoverer, Michael Howard, of the Las Cruces District of the Bureau of Land Management, whose attention to natural biota resulted in the discovery of this *Anulocaulis*. Mike has a strong sense of responsibility for the nation's natural resources, shares his knowledge willingly with the public, and works toward making land-use in the Southwest compatible with needs for conservation.

PARATYPES: **NEW MEXICO. Otero Co.:** ca. 30 air mi NE of Dell City, Texas, foothills of Guadalupe Mtns. at mouth of Pup Canyon, extreme SE corner of Sec 23, T22S, R18E, 26 Sep 1996, *Wootten and Howard s.n.* (NMC); 48 km NNE of Dell City, Texas, W base of Guadalupe Mts., N of mouth of Pup Canyon, edge of Lincoln National Forest, ca. 300 m ENE of SW corner S24 T22S R18W, 32°22.22'N, 105°74'W, elev. 1360 m, 5 Aug 1997, *Spellenberg, Wootten and Howard 12435* (ARIZ, NMC, UC); 49 km NNE of Dell City, Texas, W base of Guadalupe Mts., N of mouth of Pup Canyon, NE Sec 23, T22S, R18W, 32°22.75'N, 105°03.99'W, elev 1460 m, 5 Aug 1997, *Spellenberg, Wootten and Howard 12438* (NMC).

Anulocaulis leiosolenus var. *howardii* is immediately distinguishable from close relatives by the combination of the semi-glaucous leaves with only a few large multicellular trichomes, the reddish-pink perianth, and the moderately broad rim on the fruit (Table 1). The fruit is most similar to that illustrated in Spellenberg (1993, Fig. 1F), a fruit from a Texas race of *A. leiosolenus* var. *leiosolenus*. Within the complex, minute hairs at the tip of the perianth, best seen in bud, were previously known only in the var. *lasianthus*.

As illustrated in Table 1, the new variety has some of the characteristics that are used alone or in combination to distinguish among other members of the *A. gypsogenus-leiosolenus* complex (Spellenberg 1993). For this reason we believe the newly discovered entity is best recognized as a variety in a more broadly reconstructed *A. leiosolenus*, in which *A. gypsogenus* is included at the varietal level. The entire complex presents a classic representation of completely allopatric, closely related, more or less distinguishable races, this structure commented upon by Spellenberg (1993). Mayr (1969, ch. 3) dis-

Table 1. A comparison of some characteristics used to distinguish varieties within *Anulocaulis leiosolenus.*

Variety of *A. leiosolenus*	Perianth limb color	Perianth pubescence	Leaves	Fruit wing
gyspsogenus	white to very pale pinkish	none	pale bluish green, glaucous, smooth, pale gray or whitish when dried	0.8–1.2 mm
howardii	deep rose pink	minute trichomes at tip in bud	bluish green, semi-glaucous, few largeconical tubercules, grayish green when dried	0.2–0.9 mm
lasianthus	pale pink to pink	minute trichomes at tip in bud	green, semi-glaucous, dense conical tubercules, dull green when dried	0.2–0.6 mm
leiosolenus	white to pale pink	none	green, not especially glaucous, dense conical tubercules, dull green when dried	0.2–0.6 mm

cussed problems with deciding taxonomic divisions in allopatric populations; Stuessy (1990, ch. 12) discussed problems with assigning infraspecific taxa to varieties or subspecies. With regard to *Anulocaulis,* the tradition of using variety is followed for taxonomic recognition of closely related, internally rather homogeneous populations that can be distinguished from other, similar populations.

Spellenberg (1993) noted the similarity between the large, pale perianth of the western race of *A. leiosolenus* var. *leiosolenus* and that of *A. gypsogenus.* On a more subtle note, the var. *howardii* has flowers clustered in the inflorescence reminiscent of var. *lasianthus*. This characteristic is somewhat developed in *A. gypsogenus* and much less so in the var. *leiosolenus*. The leaves of the var. *howardii* are more similar to *A. gypsogenus.* The fruits are rather intermediate between *A. leiosolenus* and *A. gypsogenus*, as traditionally recognized. It is our view that with the discovery of the easily recognizable race now named as *A. leiosolenus* var. *howardii*, the other phases in this complex of gypsophilic endemics are best recognized as belonging to one geographically fragmented (Fig. 1) species of variably differentiated allopatric races. For that reason, we transfer *A. gypsogenus* into *A. leiosolenus* as a variety restricted to the gypsum along the Pecos River, slightly to the east of, but completely disjunct from var. *howardii*.

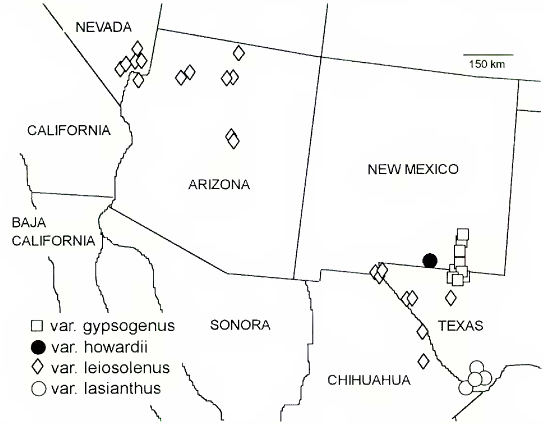

FIG. 1. Map of states of southwestern United States and northwestern Mexico showing the distribution of *Anulocaulis leiosolenus* varieties.

Anulocaulis leiosolenus (Torr.) Standl. var. **gypsogenus** (Waterf.) Spellenb. & T. Wootten, comb. nov. BASIONYM: *Anulocaulis gypsogenus* Waterf., Rhodora 47:329. 1945. TYPE: UNITED STATES. NEW MEXICO. Chaves Co.: Comanchean Bluffs, 7 mi E of Roswell, 9 Oct 1944, *Waterfall 5701* (HOLOTYPE: GH!; ISOTYPES: NY! MO!).

KEY TO TAXA OF *ANULOCAULIS*

1. Anthocarp without a prominent equatorial ridge or wing; perianth less than 16 mm long, the lobes flaring but not reflexed.
   2. Perianth 15–16 mm long at anthesis, purplish, the tube externally glabrous, minutely glandular-pubescent near the apex; anthocarp ellipsoid or broadly fusiform (southern Coahuila). .... **A. hintoniorum** B. L. Turner
   2. Perianth less than 10 mm long at anthesis, whitish to rose-lavender, the tube externally villous; anthocarp fusiform or turbinate.
      3. Flowers usually 5–15 in umbel-like clusters; tube of perianth not elongating after anthesis; anthocarp broadly fusiform (southeastern California). .... **A. annulatus** (Coville) Standl.
      3. Flowers usually borne singly; tube of perianth markedly elongating after anthesis; anthocarp turbinate, bluntly 5-angled, ridges indefinite (southern Texas, western Coahuila, possibly eastern Chihuahua). .... **A. eriosolenus** (A. Gray) Standl.
1. Anthocarp with a prominent equatorial ridge or wing; perianth 10–35 mm long, the lobes flaring or sharply reflexed.

4. Perianth ca. 10 mm long, the lobes sharply reflexed (northeastern Chihuahua and immediately adjacent Texas). .... **A. reflexus** I. M. Johnst.
4. Perianth 22–35 cm long, the lobes flaring, not reflexed .... **A. leiosolenus** (Torr.) Standl.
    5. Leaves smooth, glaucous; perianth glabrous externally at apex (Pecos River in southestern New Mexico and western Texas). .... var. **gypsogenus** (Waterf.) Spellenb. & T. Wootten
    5. Leaves at least sparsely tuberculate; perianth minutely puberulent or glabrous at the apex.
        6. Perianth glabrous externally at the apex (extreme western Texas, south-central New Mexico, north-central Arizona, and southern Nevada) .... var. **leiosolenus**
        6. Perianth minutely pubescent externally at the apex (visible best when in late bud).
            7. Leaves grayish green; purplish tubercules on leaves sparse; perianth deep rose-pink (south-central New Mexico, W face of Guadalupe Mts. .... var. **howardii** Spellenb. & T. Wootten
            7. Leaves green or dark green; purplish tubercules on leaves dense; perianth pale pink to pink (Big Bend region of Texas and immediately adjacent Chihuahua) .... var. **lasianthus** I.M. Johnston

A NEW VARIETY OF *MENTZELIA HUMILIS*

Mentzelia humilis (Urb. & Gilg) J. Darl. is a variable yet distinctive member of sect. *Bartonia* Torr. & A. Gray restricted to gypseous substrates in southeastern New Mexico and western Texas (Thompson 1997). Leaves vary from pectinate to entire. Usually leaves in a population are similar, but occasionally populations will have pectinate and entire leaves (*Sivinski and Lightfoot 2634;* cited *Mentzelia* specimens comprise Appendix 2). Leaves may be clearly pectinate, the lobes distantly spaced and linear, 1–2 mm wide and about 15 mm long, or lobes may be much shorter. Lobes may be straight or somewhat falcate, curving toward the leaf apex. In either case, the margins of a lobe are approximately parallel and the apex of the lobe is almost always rounded. In some cases lobes are completely absent and leaves are entire and linear. Basal leaves may be much less lobed than cauline leaves (*Higgins 6845*). Other than by flower color (not given, but presumably white) *Higgins 6845*, from western Texas, cannot be distinguished from a pectinately lobed form of *M. perennis* H. J. Thompson (ined.) from central New Mexico (*Edwards and Repass 4726; Spellenberg and Willson 4233; Ward et al. 81-281*), leaving one to ponder the distinction of these two taxa.

Specimens of this complex in NMC have been annotated as either *M. humilis* or *M. perennis* by H. J. Thompson. Martin and Hutchins (1981) separated these two taxa in their key on a vegetative character, tufted (*M. perennis*) vs. not tufted (*M. humilis*), a feature that will not distinguish them. They give flower color of the former as "pale lemon-yellow," which is approximately correct, vs. "yellow" for *M. humilis*, which is incorrect (pale ochroleucuous to white). Perhaps Martin and Hutchins were following to some degree Wooton and Standly (1915) who noted petals to be "pale yellow" (in *Nuttallia gypsea* Wooton & Standl., a synonym of *M. humilus*), or Darlington (1934), who "keyed" *M. humilis* under "flowers lemon-yellow to golden." This assumption of yellow-colored flowers is understandable because buds are cream and dried petals in fresh specimens are definitely yellowish. Thompson and Zavortink (1970) may be the first to have indicated that *M. humilis* corollas and androecia were white. Later Thompson (1997) described the petals as "white or very pale yellow." *Mentzelia perennis* has pale yellow petals.

In Thompson (1997) and Thompson and Zavortink (1970), *Mentzelia* specimens from the gypsum outcrop discussed earlier key to *M. strictissima* (Wooton & Standl.) J. Darl., but this is a very different, tall plant that occurs in (often) sandy soil. It has dentate leaves and cylindrical capsules. Leaves of the novel *Mentzelia* much more closely resemble those of *M. mexicana* H. J. Thomps. & Zavort. or *M. saxicola* H. J. Thomps. & Zavort. as illustrated in Thompson and Powell (1981, fig. 7). These are yellow-flowered species of western Texas and northern Mexico once confused with *M. multiflora* (Nutt.) A. Gray. Unfortunately, Thompson and Powell did not discuss the relationship of *M. humilis* to any of these species. In a survey of other specimens, leaves from the novel plants from the gypsum outcrop on the western slope of the Guadalupe Mountains more closely resemble those of some specimens of *M. multiflora*, and also resemble that illustrated in Thompson and Powell (1981, fig. 7) for this species.

Thompson and Powell (1981) illustrated, described, and compared the seed coats of *M. multiflora* with seed coats of *M. mexicana* and *M. saxicola*. They noted the first to have cells with swollen outer walls covered by numerous small papillae. This gives the seed coat a coarsely granular appearance or, as stated in Thompson (1997), it is "rough with papillae." Seed coats of the latter two have fewer papillae and appear "smooth" (Thompson 1997), but actually are very finely granular under a microscope at about 20x. Thompson did not give the characteristics of seed coats of *M. humilis*; we note them to be very similar to those of *M. multiflora*, as are the seed coats of the novel *Mentzelia* in question.

Thompson, in attempting to work out distinctions between New Mexico populations of *M. multiflora*, *M. jemezensis*, *M. humilis*, and *M. strictissima* sent Spellenberg a letter (29 Apr 1980), a map, and color photographs (without provenance) explaining his interpretation (filed at NMC, accession #60536, in *M. jemezensis* folder). *Mentzelia multiflora* and *M. humilis* have very distinct flowers, the first yellow (Thompson's photo is more yellow than most races in southern New Mexico, which may be pale yellow), *M. humilis* near white. More important *M. multiflora* has broader petals with the transition to stamens with expanded filaments comparatively abrupt, whereas *M. humilis* has narrower petals, the transition to stamens more gradual. Flowers from the new *Mentzelia* in question very strongly resemble those of the photo and of specimens of *M. humilis* and are not like those of *M. multiflora*.

Thompson (1997) indicated capsules of *M. multiflora* to be cylindrical, 15–25 mm long, whereas he wrote that *M. humilis* has capsules cup-like, 6–13 mm long. The novel *Mentzelia* has capsules that are cup-shaped and in the lower range of length for those of *M. humilis*. Plants of the new population are densely clumped, like some races of *M. humilis*, and leaves are sub-entire, dentate, or pinnatisect, reminiscent of those of *M. multiflora*. When the leaves are pinnatisect, the lobes taper from a broad base to a narrow, acute or even acuminate tip. The flowers and capsules are like those of *M. humilis*. The inflorescence is much more congested than in any of the species mentioned.

The map Thompson provided with his letter to Spellenberg (29 Apr 1980) shows *M. humilis* to occur in western Texas and eastern New Mexico in the Pecos River drainage, distinctly, but not distantly, east of the population in question. He maintained this distribution for *M. humilis* in his 1997 manuscript. On his map accompanying the letter, *M. perennis* is shown to occur in a limited area to the northwest of the site from which the new *Mentzelia* originates. *Mentzelia multiflora*, in contrast, is widespread in the western United States and northern Mexico (Thompson 1997). It is known from robust to smaller plants in the Guadalupe Mountains (*e.g., Spellenberg 3660, Wooton s.n.*). Both these specimens have broad petals and cylindrical capsules representative of the species; Spellenberg noted flower color as "pale yellow" on the specimen label. In his letter Thompson alluded to the possibility of gene flow between isolated edaphic endemics and more widespread edaphically unrestricted species. Such a process might explain in the new variety the leaves similar to *M. multiflora* and the flowers and capsules similar to *M. humilis*. Observations from these populations reveal that flowers and capsules of the novel *Mentzelia* are consistent, foliage and habit are variable. Nevertheless, the race is consistently distinct from *M. humilis* var. *humilis* and is geographically isolated from it: var. *humilis* east of the Guadalupe Mountains, var. *guadalupensis* restricted to the western slope.

Mentzelia humilus (A. Gray) Darl. var. **guadalupensis** Spellenb., var. nov. (**Fig.** 2). TYPE: UNITED STATES. NEW MEXICO. Otero Co.: 48 km NNE of Dell City, Texas, W base of Guadalupe Mts., N of mouth of Pup Canyon, S14 T22S R18W, 32°22.74'N, 105°04.26'W, elev. 1460 m., 22 Sep 1997, *Spellenberg & Wootten 12455* (HOLOTYPE: NMC; ISOTYPES: NY, TEX, UC, UNM).

A Mentzeliae humili var. humili foliis dentatis vel pinnatisectis (vs. pectinatis vel integris), rachidibus 2–8 mm (vs. 1–2 mm) latibus, inflorescentiis congestibus (vs. noncongestibus), et plerumque pedicellis capsulis brevioribus (vs. aequantibus vel longioribus) differt.

Plants 0.5–2.5 dm tall; basal leaves spatulate, dentate, with 2–4 teeth

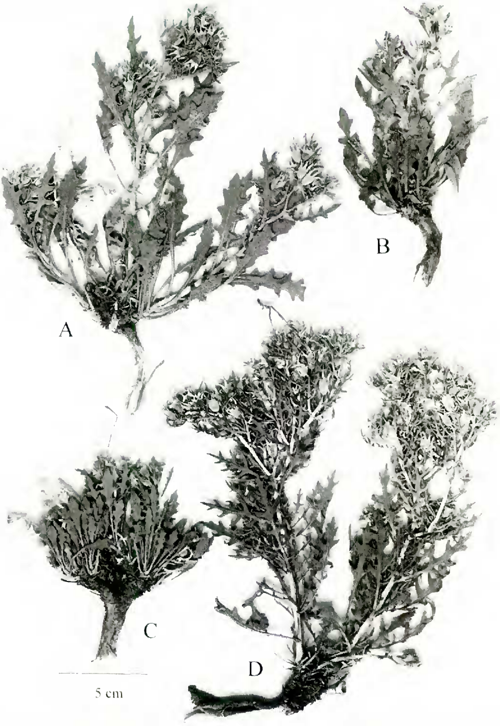

FIG. 2. Illustration of plants comprising the type collection of *Mentzelia humilis* var. *guadalupensis* (*Spellenberg & Wootten 12455*). Collection was made with the intent of illustrating the major aspects of variation in the population: habit and leaf dissection. All plants are clearly identified in distributed specimens by small tags affixed to them. All plants in photograph are at NMC. Plant A is the holotype plant, which has been mounted separately from isotypes at NMC; other portions of plant A have been distributed with other isotype plants to NY, UC; plant B, NMC, NY; plant C, NMC, NY; plant D, NMC, TEX, UC, UNM. Plants similar to A–C are common in the population; plants with leaves dissected to the extent of plant D are less common.

per side, or sometimes the smallest basal leaves nearly entire; midstem leaves, 3.0–8.5 cm long, 8–21 mm wide, the blade spatulate or lanceolate in outline, tapering gradually to a slender petiole, the blade from shallowly to deeply dentate or pinnatisect, 3–7 teeth or lobes per side, when pinnatisect or deeply dentate the rachis 2–8 mm wide and the lobes straight or sometimes falcate, tapering from base to acute tip; bracts beneath the heads pinnatisect, 2–4 lobes per side; petals white or pale ochroleucous when fresh (drying ochroleucous), about 10 (intergrading with the outer stamens with broad filaments), 10–13 mm long, 1.6–2.1 mm wide, acute; capsules cupulate, 5–8 mm long, 5–6 mm wide, the length 1–1.7 times the width, the calyx lobes on capsules 4–9 mm long, narrowly triangular-subulate; seeds 1.8–2.2 mm long with a wing 0.5 mm wide, the seed coat conspicuously papillate (use 20x), the papillae hemispheric and minutely granular.

As far as is known, *Mentzelia humilis* var. *guadalupensis* is restricted to the west slope of the Guadalupe Mountains on gypsum of the Yeso Formation, probably occurring throughtout the outcrop as described in the introduction. The varietal epithet refers to its presence in the Guadalupe Mountains.

Paratypes: **NEW MEXICO. Otero Co.:** 49 km NNE of Dell City, Texas, W base of Guadalupe Mts., N of mouth of Pup Canyon, NE S23, T22S, R18W, 32°22.75'N, 105°03.99'W, elev. 1460 m, 5 Aug 1997, *Spellenberg, Wootten, and Howard 12440* (NMC); 2.5 km S of the Chaves Co. line, just west of The Rim on the west slope of rhe Guadalupe Mts., about 100 m inside the Lincoln National Forest, center S7, T21S, R18E, 32°29.65'N, 105°08.28'W, elev. 1540 m, 27 Jul 1998, *Spellenberg & Wootten 12500* (NMC, RM).

APPENDIX 1

The following list provides the names of plants that we collected or observed on the outcrop; collection numbers are Spellenberg's. Deposition of specimens is indicated by herbaria codes as presented in Holmgren et al. (1990). Each name is also followed by "C, O, or U," signifying generally "common, occasional, or uncommon," respectively, on the outcrop.

Agavaceae: *Dasylirion wheeleri* S. Wats. [O]; *Yucca elata* Englem. [U]; *Yucca torreyi* Shafer [O]

Amaranthaceae: *Tidestromia suffruticosa* (Torr.) Standl. var. *suffruticosa*, *12481* (NMC) [U]

Anacardiaceae: *Rhus microphylla* Engelm. [U]

Apocynaceae: *Amsonia longiflora* Torr. var. *salpignatha* (Woodson) McLaughlin, *12434* (NMC, NY, UNM), *12441* (NMC, NY), *12474* (NMC, NY), *12501* (NMC, NY) [C]

Asclepiadaceae: *Asclepias macrotis* Torr., *12507* (NMC, NY) [U]

Asteraceae: *Brickellia laciniata* A. Gray [U]; *Gaillardia multiceps* Greene [U]; *Gutierrezia microcephala* (DC.) A. Gray [O]; *Haploësthes greggii* A. Gray, *12437* (NMC) [C]; *Machaeranthera pinnatifida* (Hook.) Shinners var. *pinnatifida*, *12505* (NMC) [U]; *Porophyllum scoparium* A. Gray, *12436* (NMC, UC) [C]; *Sartwellia flaveriae* A. Gray [U]; *Thelesperma megapotamicum* (Spreng.) Kuntze [U]; *Thymophylla acerosa* (DC.) Strorher, *12484* (NMC) [U]; *Thymophylla pentachaeta* (DC.) Small var. *hartwegii* (A. Gray) Srrother, *12475* (NMC, NY), *12483* (BRIT) [O]; *Viguieria stenoloba* S. F. Blake [O]

Boraginaceae: *Tiquilia hispidissima* (Torr.) A. Richardson, *12502* (NMC) [O]

Brassicaceae: *Nerisyrenia camporum* (A. Gray) Greene, *12442* (NMC) [C]

Cactaceae: *Coryphantha tuberculosa* (Engelm.) A. Berger, *12482* (NMC) [U]; *Echinocactus horizonthalonius* Lemaire [U]; *Echinocereus dasyacanthus* Englem., *12486* (NMC) [O]; *Opuntia imbricata* (Haw.) DC. [U]; *Opuntia macrocentra* Engelm., *12487*, spineless (NMC), *12488*, spines (NMC) [O]; *Opuntia phaeacantha* Englem. var. *phaeacantha* [U]

Chenopodiaceae: *Atriplex canescens* (Pursh) Nutt. [U]

Ephedraceae: *Ephedra aspera* S. Wats., *12473* (NMC) [O]

Euphorbiaceae: *Chamaesyce fendleri* (Torr. & Gray) Small, *12458* (NMC), *12471* (NY) [O]; *Croton dioicus* Cav. [O]

Fabaceae: *Acacia neovernicosa* Isely [O]

Fouquieriaceae: *Fouquieria splendens* Engelm. [O]

Hydrophyllaceae: *Nama carnosum* C. L. Hitchc., 12503 (NMC), [O]

Krameriaceae: *Krameria erecta* Schult., *(12478)* [O]

Lamiaceae: *Hedeoma nanum* (Torr.) Briq., *12479* (NMC) [U]

Linaceae: *Linum vernale* Wooton, *12480* (NMC) [U]

Loasaceae: *Cevallia sinuata* Lag. [U]; *Mentzelia humilis* (A. Gray) J. Darl. var. *guadalupensis* Spellenb., *12440* (NMC), *12455* (NMC, NY, TEX, UNM),*12500* (NMC, RM) [C]

Malvaceae: *Sphaeralcea coccinea* (Nutt.) Rydb., *12476* (NMC) [U]

Nyctaginaceae: *Allionia incarnata* L. var. *incarnata* [O]; *Anulocaulis leiosolenus* (Torr.) Standl. var. *howardii* Spellenb. & T. Wootten, *12433, 12435, 12438* [C]; *Mirabilis linearis* (Pursh) Heimerl, *12506* (NMC) [U]; *Selinocarpus lanceolatus* Wooton var. *lanceolatus*, *12452* (NMC), 12499 (NMC) [O

Oleaceae: *Menodora scabra* A. Gray [U]

Onagraceae: *Gaura coccinea* Nutt. [U]; *Calylophus hartwegii* (Benth.) Raven subsp. *filifolius* (Eastw.) Towner & Raven, *12472* (NMC) [O]

Poaceae: *Aristida purpurea* Nutt. var. *nealleyi* (Vasey) Allred, *12453* (NMC) [U]; *Aristida pansa* Wooton & Standl. var. *pansa*, *12456* (NMC) [U]; *Bothriochloa laburoides* (DC.) Herter subsp. *torreyana* (Steud.) Allred & Gould, *12459* (NMC) [U]; *Bouteloua warnockii* Gould & Kapadia, *12443* (NMC) [O]; *Dasyochloa pulchella* (Kunt.) Steud. [U]; *Digitaria cognata* (Schult.) Pilg. subsp. *pubiflora* Wipff & Hatch, *12457* (NMC) [U]; *Setaria leucopila* (Scribn. & Merr.) K. Schum. [U]; *Sporobolus cryptandrus* (Torr.) A. Gray, *12504* (NMC) [O]; *Stipa curvifolia* Swallen, *12477* (NMC, NY) [U]; *Tridens muticus* (Torr.) Nash var. *muticus*, *12454* (NMC) [U]

Polygonaceae: *Eriogonum havardii* S. Wats., *12439* (NMC) [C]

Pteridaceae: *Astrolepis cochisensis* (Goodd.) D. M. Benham & Windham, *12444* (NMC) [O]

Rosaceae: *Fallugia paradoxa* (D. Don) Endl. [U]

Rubiaceae: *Hedyotis nigricans* (Lam.) Fosberg, *12445* [O]

Solanaceae: *Nicotiana trigonophylla* Dunal (NMC) [U]

APPENDIX 2

Collections of *Mentzelia* cited in discussion of *M. humilus* var. *guadalupensis*. Deposition of specimens is indicated by herbaria codes as presented in Holmgren et al. (1990).

Mentzelia humilis (A. Gray) Darl.—*Higgins 6845*. Texas, Culberson Co., 26 mi E of Hwy. 62-180 along Hwy 652, gypsum soil, 21 May 1973 (NMC); *Sivinski & Lightfoot 2634*, New Mexico, Guadalupe Co., 2.3 mi S of Pecos River bridge at Puerto de Luna, 21 Oct 1993 (NMC, UNM).

Mentzelia multiflora (Nutt.) A. Gray.—*Spellenberg 3660*, New Mexico, Otero Co., Guadalupe Mts. on Guadalupe Rim Rd #67, 8 Sep 1973 (NMC); *Wooton s.n.*, New Mexico, [without county], Guadalupe Mts., west slope, 3 Aug 1909 (NMC).

Mentzelia perennis Wooton.—*Edwards & Repass 4726*, New Mexico, Socorro Co., ca. 8 mi E of Socorro, 23 Jul 1977 (NMC); *Spellenberg & Willson 4233*, New Mexico, Socorro Co., 8 mi (by air) ENE of Bingham, W edge Chupadera Mesa, 8 Jul 1976 (NMC); *Ward, Spellenberg, & Soreng 81-281*, New Mexico, Lincoln Co., W base of Cerro Tecolote Peak, 12 mi SSW of Corona, roadside or US 54, 3 Jul 1981 (MO, NMC, NY–originally identified as *M. pumila* (Nutt.) Torr. & A. Gray).

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